

Modularized TGF β -Smad Signaling Pathway

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The Transforming Growth Factor β (TGF β) signaling pathway is a prominent regulatory signaling pathway controlling various important cellular processes. It can be induced by several factors, including ionizing radiation. It is regulated by Smads in a negative feedback loop through promoting increases in the regulatory Smads in the cell nucleus, and subsequent expression of inhibitory Smad, Smad7 to form a ubiquitin ligase with Smurf targeting active TGF β receptors for degradation. In this work, we proposed a mathematical model to study the radiation-induced Smad-regulated TGF β signaling pathway. By modularization, we are able to analyze each module (subsystem) and recover the nonlinear dynamics of the entire network system. Meanwhile the excitability, a common feature observed in the biological systems, along the TGF β signaling pathway is discussed by mathematical analysis and numerical simulation.